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**Attn: Examiner Hoanganh T. Le**
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| Title of Document Transmitted: | **TRANSMITTAL DOCUMENTS (2) AND BRIEF OF APPELLANTS** |
| Applicant: | Samir F. Bassily |
| Serial No.: | 10/796,481 |
| Filed: | March 9, 2004 |
| Group Art Unit: | 2821 |
| Title: | SYSTEM AND METHOD FOR PREFERENTIALLY CONTROLLING GRATING LOBES OF DIRECT RADIATING ARRAYS |
| Our Ref. No.: | PD-01-439 |

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| Applicant: | Samir F. Bassily | Examiner: | Hoanganh T. Le |
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MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
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Dear Sir:

We are transmitting herewith the attached:

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Due Date: March 7, 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

| | |
|---|---|
| In re Application of: | |
| Inventor: Samir F. Bassily | Examiner: Hoanganh T Le |
| Serial No: 10/796,481 | Group Art Unit: 2821 |
| Filed: March 9, 2004 | Appeal No.: Not Yet Assigned |
| Title: SYSTEM AND METHOD FOR PREFERENTIALLY CONTROLLING GRATING LOBES OF DIRECT RADIATING ARRAYS | |

## BRIEF OF APPELLANTS

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In accordance with 37 CFR §1.192, Appellants hereby submit the Appellants' Brief on Appeal from the final rejection in the above-identified application, as set forth in the Office Action dated February 7, 2006.

Please charge the amount of $500.00 to cover the required fee for filing this Appeal Brief as set forth under 37 CFR §1.17(c) to Deposit Account No. 50-0494. Also, please charge any additional fees or credit any overpayments to Deposit Account No. 50-0494.

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I. REAL PARTY IN INTEREST

The real party in interest is The Boeing Company, the assignee of the present application.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences for the above-referenced patent application.

III. STATUS OF CLAIMS

Claims 1-22 are pending in the application.

Claims 1-4, 7, 14-17, 19, and 20 are rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,384,516 (Fraser), and these rejections are being appealed.

Claims 5, 6, 8-13, and 18 are rejected under 35 U.S.C. §103(a) as being obvious in view of Fraser, and these rejections are being appealed.

Claims 21 and 22 are objected to and indicated as allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

IV. STATUS OF AMENDMENTS

No amendments to the claims have been made subsequent to the final Office Action.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A DRA (108) with preferentially controlled grading lobes (208) is described. The DRA (108) comprises a plurality of elements (112), collectively defining a main lobe (206) nearest the DRA boresight (212) and a set of grating lobes (208) near the main lobe (206). The DRA (108), plurality of elements (112) defined main lobe (206) and grating lobes 208 are generally illustrated in FIG 2, and discussed in the Applicant's specification at page 4, line 3-17. Each of the grating lobes in the set of grating lobes (208) is angularly displaced from the main lobe (206) by a grating lobe angle ($\theta_g$ shown in FIG. 2) that varies asymmetrically about that main lobe (206).

The Applicant's specification describes a number of different embodiments of the invention. One embodiment is shown and described with respect to FIG. 5A and page 6, line 4 through page 7, line 9.

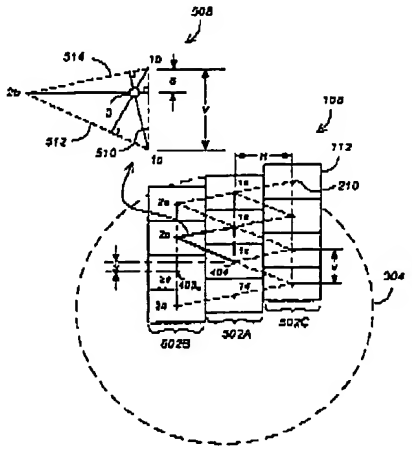


*FIG. 5A*

In this embodiment, the plurality of elements comprises a first row of elements (502A) extending in a first direction, and a second row of elements (502B), parallel to the first row of elements (502A), the second row of elements (502B) offset from the first row of elements (502A) in the first direction by a stagger distance S. Further embodiments are shown in FIGs. 6A (staggered elements), 7A (tilted and staggered), 8A (non-square elements), and 9A (varying stagger), with the resulting main and grating lobes as shown in FIGs. 6B, 7B, 8B, and 9B, respectively.

The Applicant's invention is also described by a method of defining a direct radiating array (DRA). The steps include the step of defining a first row of elements extending in a first direction (FIG. 4A and 5A, page 5, lines 21-25), each element of the first row of elements being spaced apart from an adjacent element in the first row of elements by a distance V (FIG. 4A and 5A, specification, page 6, lines 14-24), defining a second row of elements parallel to the first row of elements, each element of the second row of elements being spaced apart from an adjacent element of the second row of elements by the distance V, and the second row of elements spatially displaced from the first row of elements in a direction perpendicular to the first direction by a distance H (FIG. 4A and 5A, specification, page 6, lines 14-24), wherein the second row of elements is offset

from the first row of elements in the first direction by a stagger distance $S$ such that S/V is between zero and one. The foregoing is illustrated in the Applicant's specification at FIGs. 4A-4C and 5A-5D and is described in the specification at page 6, line 25 - page 8, line 22)

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 1-4, 7, 14-17, 19, and 20 are Patentable over U.S. Patent No. 6,384,516 (Fraser) Under 35 U.S.C. §102(b); and

Whether claims 5, 6, 8-13, and 18 are Patentable over Fraser Under 35 U.S.C. §103(a).

VII. ARGUMENT

A. The Reference(s)

*1. The Fraser Reference*

U.S. Patent No. 6,384,516, issued May 7, 2002 to Fraser discloses a Hex packed two dimensional ultrasonic transducer arrays. A two dimensional ultrasonic transducer array suitable for three dimensional phased array scanning is formed of hexagonally close packed transducer elements. In a preferred embodiment the transducer elements have a rectilinear shape, allowing the array to be fabricated with conventional dicing saw processes.

B. Claims 1-4, 7, 14-17, and 19-20 are Patentable Over the Fraser Reference Under 35 U.S.C. § 102(b)

*1. Claims 1-4, 7, 14-17, and 19-20 Recite Structural Elements and Not an "Intended Use"*

In response to the Applicant's arguments presented in the Amendment filed September 6, 2005 (reproduced below), the Final Office Action argues:

> "... a recitation of an intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, than it meets the claim."

The Applicants traverse for three reasons.

First, claim 1 does not recite an "intended use." It recites a structural difference between the applicants invention (the asymmetric nature of the grating lobe displacement about the DRA main lobe) and the prior art.

Second, even if the recitation "wherein each of the grating lobes in the set of grating lobes is angularly displaced from the main lobe by a grating lobe angle that varies asymmetrically about the DRA main lobe" *were* a recitation of an intended use, the claim would be allowable, since the prior art structure *is not capable* of generating grating lobes that are "angularly displaced from the main lobe by a grating lobe angle that varies asymmetrically about the DRA main lobe".

Third, whatever the merits or demerits of the "intended use" argument with respect to claim 1, it can have no application to claims 2-20, as those claims are replete with structural features.

*2. Claims 1-4, 14-17, and 19-20 are Patentable over the Fraser Reference under 35 U.S.C. § 102(b)*

With Reference to Claims 1 and 4: Claim 1 recites:

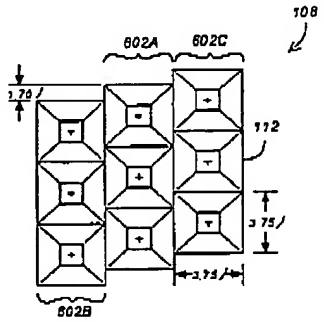
> *A direct radiating array (DRA), comprising:*
> *a plurality of elements, collectively defining a DRA main lobe nearest a DRA boresight and a set of grating lobes nearest the DRA main lobe,*
> *wherein each of the grating lobes in the set of grating lobes is angularly displaced from the main lobe by a grating lobe angle that varies asymmetrically about the DRA main lobe.*

Claim 1 recites that each of the grating lobes are angularly displaced from the main lobe by a grating lobe angle that varies asymmetrically about the DRA main lobe. On page 3, the first Office Action indicates that Fraser discloses this feature, but does not indicate where such feature is disclosed. The Applicant has reviewed the Fraser reference, and can find no such disclosure.

One of the key advantages of the Applicant's invention is described in the specification:

The elements 112 can thus be considered to be arranged in a general triangular configuration. Although the stagger distance $S$ may be set to ½ $V$ (in which case triangle 508 would be an isosceles triangle), it is preferable that the stagger distance $S$ to not be restricted to ½ $V$, (e.g. by choosing $S$ and $V$ such that $S/V$ is between zero and one) thus providing a generally asymmetrical grating lobe pattern that can be advantageously used to compliment the inherently asymmetrical coverage area typically used in geostationary satellites 100 transmitting signals to certain geographic areas such as the continental United States (CONUS). (Specification, page 6 line 29- page 7, line 5)

An exemplary DRA is shown in FIG. 6A:



This DRA results in grating lobes which are angularly displaced from the main lobe by a grating lobe angle that varies asymmetrically about the DRA main lobe, as shown in FIG. 6B:

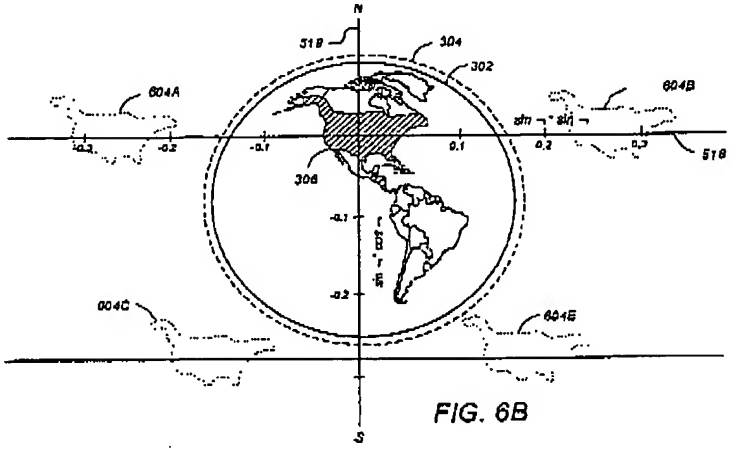
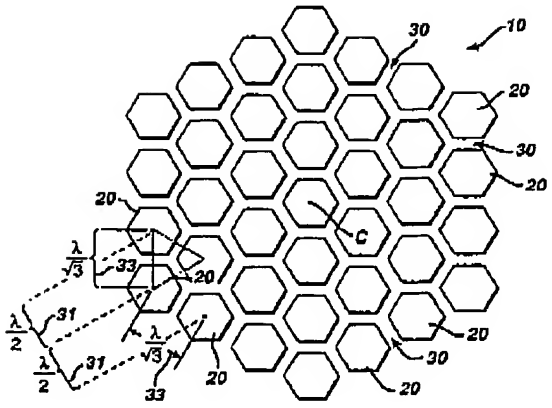



FIG. 6B

In an embodiment described in claim 4, the stagger distance $S \neq \frac{1}{2}V$, resulting in the non-isosceles triangle geometry, and the asymmetric grating lobes. This creates an asymmetrical grating pattern can be used to complement the typically asymmetrical coverage pattern of geostationary satellites transmitting to CONUS (see specification, page 7).

The Fraser reference fails to disclose a DRA having asymmetrically varying grating lobe angles or a DRA having the necessary characteristics to create such asymmetric grating lobes. In fact, Fraser teaches a stagger distance of $S = \frac{1}{2}V$. Note, for example, that FIG. 1 shows a system in which the stagger distance forms an isosceles triangle with $S = \frac{1}{2}V$ (the Applicant has modified FIG. 1 to include lines between the center of the elements to show the isosceles structure):

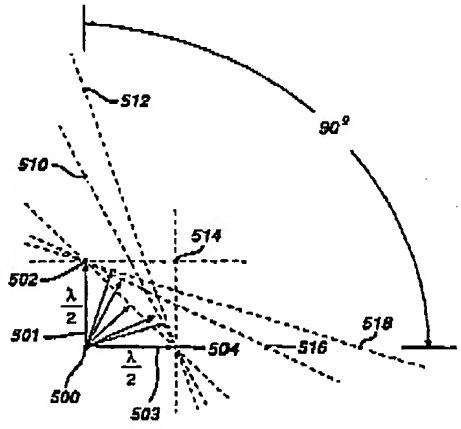
FIG. 1




FIGs. 1b and 1c likewise show isosceles embodiments in which the stagger distance $S = \frac{1}{2}V$.

With Respect to Claim 7: Claim 7 recites that the first direction is tilted from a North direction by a tilt angle between 0 and 90 degrees. The first Office Action indicates that this is discloses in FIG 1b as follows:

FIG. 1b

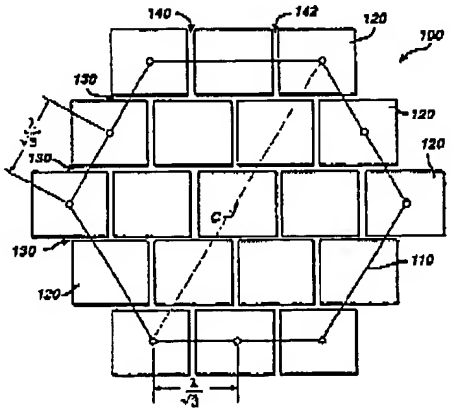



But this does not disclose a tilt angle of the array relative to North at all, but instead, angles between elements of the array.

With Respect to Claim 14: Claim 14 recites that the second row of elements is offset from the first row of elements in the first direction and that the third row of elements is offset from the first row of elements in the first direction according to a stagger distance $S$ that varies as a random function of a distance from the first row of elements extending in a second direction perpendicular from the first direction. It does not appear as if this claim has been addressed.

With Respect to Claim 15-17: Claim 15 recites that the second row of elements is offset from the first row of elements in the first direction and that the third row of elements is offset from the first row of elements in the first direction according to a stagger distance $S$ that varies as a non-linear function of a distance from the first row of elements extending in a second direction perpendicular from the first direction. The first Office Action indicates that this is disclosed in FIG. 2 below:

*FIG. 2*




However, as shown on the "/" line added to FIG. 2 by the Applicants for clarification purposes, FIG. 2 discloses a stagger distance that varies as a *linear* function of the distance between the first row of elements.

Claim 16 recites that the function proportional to a square function. This is likewise not disclosed in the Fraser reference.

Claim 17 recites that the angle of the first row of elements is tilted from the North direction ... the Fraser reference likewise does not mention this feature.

C. Claims 5, 8, 8-13 and 18 are Patentable Over the Fraser Reference Under 35 U.S.C. § 103(a)

*1. Claims 5, 8, 8-13 and 18 Recite Structural Elements and Not an "Intended Use"*

As described above, the claims upon which claims 5, 8, 8-13 and 18 depend recite structural elements. The Applicant therefore traverses the rejection of these claims under the "intended use" rationale as well.

*2. Claims 5, 8, 8-13 and 18 are Patentable over the Fraser Reference Under 35 U.S.C. § 103(a)*

According to the first Office Action, it would have been a simple matter of design choice to choose the parameters listed in claims 5, 6, 8-13, and 18, and characterizes the parameters as a change of size. However, selection of these parameters is not simply a change in size. These parameter selections permit biasing asymmetrical grating patterns to avoid earth interference while maintaining the utilization efficiency. Accordingly, the Applicant respectfully traverses these rejections.

VIII. CONCLUSION

In light of the above arguments, Appellant respectfully submits that the cited references do not anticipate nor render obvious the claimed invention. More specifically, Appellant's claims recite novel physical features which patentably distinguish over any and all references under 35 U.S.C. §§ 102 and 103. As a result, a decision by the Board of Patent Appeals and Interferences reversing the Examiner and directing allowance of the pending claims in the subject application is respectfully solicited.

Respectfully submitted,

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Attorneys for Applicant(s)

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Date: March 7, 2006

By: _____
Name: Victor G. Cooper
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VGC/kmk
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## CLAIMS APPENDIX

1. (ORIGINAL) A direct radiating array (DRA), comprising:

a plurality of elements, collectively defining a DRA main lobe nearest a DRA boresight and a set of grating lobes nearest the DRA main lobe,

wherein each of the grating lobes in the set of grating lobes is angularly displaced from the main lobe by a grating lobe angle that varies asymmetrically about the DRA main lobe.

2. (ORIGINAL) The apparatus of claim 1, wherein the plurality of elements comprises:

a first row of elements extending in a first direction; and

a second row of elements, parallel to the first row of elements, the second row of elements offset from the first row of elements in the first direction by a stagger distance S.

3. (ORIGINAL) The apparatus of claim 2, wherein:

each element of the first row of elements is spaced apart from an adjacent element in the first row of elements by a distance $V$; and

each element of the second row of elements is spaced apart from an adjacent element of the second row of elements by the distance $V$, and the second row of elements is spatially displaced from the first row of elements in a direction perpendicular to the first direction by a distance $H$.

4. (PREVIOUSLY PRESENTED) The apparatus of claim 3, wherein the stagger distance $S \neq \frac{1}{2} V$.

5. (ORIGINAL) The apparatus of claim 4, wherein:

$H = V$; and

$S \cong 0.45V$.

6. (ORIGINAL) The apparatus of claim 5, wherein $H = V = 3.75\lambda$, wherein $\lambda$ is a wavelength of a signal emanating from the DRA.

7. (ORIGINAL) The apparatus of claim 4, wherein:

the first direction is tilted from a North direction by a tilt angle between 0 and 90 degrees.

8. (ORIGINAL) The apparatus of claim 7, wherein:

the tilt angle is approximately equal to 14 degrees;

9. (PREVIOUSLY PRESENTED) The apparatus of claim 8, wherein:

$H = V$; and

$S \cong 0.496\ V$.

10. (ORIGINAL) The apparatus of claim 9, wherein $H = V \cong 3.89\lambda$, wherein $\lambda$ is a wavelength of a signal emanating from the DRA.

11. (ORIGINAL) The apparatus of claim 7, wherein:

the tilt angle is approximately equal to 6 degrees; and

$\frac{H}{V} \neq 1$.

12. (ORIGINAL) The apparatus of claim 11, wherein $\frac{H}{V} \cong 1.525$.

13. (ORIGINAL) The apparatus of claim 12, wherein $V \cong 3.54\lambda$, wherein $\lambda$ is a wavelength of a signal emanating from the DRA.

14. (ORIGINAL) The apparatus of claim 1, wherein the plurality of elements comprises:

a first row of elements extending in a first direction;

a second row of elements, parallel to the first row of elements;

a third row of elements, parallel to the first row of elements and the second row of elements;

wherein the second row of elements is disposed between the first row of elements and the third row of elements; and

wherein the second row of elements is offset from the first row of elements in the first direction and the third row of elements is offset from the first row of elements in the first direction by a stagger distance $S$ that varies as a random function of a distance from the first row of elements extending in a second direction perpendicular to the first direction.

15. (ORIGINAL) The apparatus of claim 1, wherein the plurality of elements comprises:

a first row of elements extending in a first direction;

a second row of elements, parallel to the first row of elements;

a third row of elements, parallel to the first row of elements and the second row of elements;

wherein the second row of elements is disposed between the first row of elements and the third row of elements; and

wherein the second row of elements is offset from the first row of elements in the first direction and the third row of elements is offset from the first row of elements in the first direction by a stagger distance $S$ that varies as a non-linear function of a distance from the first row of elements extending in a second direction perpendicular to the first direction.

16. (ORIGINAL) The apparatus of claim 15, wherein the distance from the first row of elements is $D$ and the function is proportional to $D^2$.

17. (ORIGINAL) The apparatus of claim 15, wherein:

the first direction is tilted from a North direction by a tilt angle.

18. (ORIGINAL) The apparatus of claim 17, wherein:

each element of the first row of elements is spaced apart from an adjacent element in the first row of elements by a distance $V$;

each element of the second row of elements is spaced apart from an adjacent element of the second row of elements by the distance $V$;

the second row of elements is spatially displaced from the first row of elements in the second direction by a distance $H$;

each element of the third row of elements is spaced apart from an adjacent element in the third row of elements by the distance $V$, and the third row of elements is spatially displaced from the second row of elements in the second direction by the distance $H$;

the tilt angle is approximately 6 degrees; and

$H \cong 5.4\lambda$ and $V \cong 3.54\lambda$, wherein $\lambda$ is a wavelength of a signal emanating from the DRA.

19. (ORIGINAL) A method of defining a direct radiating array (DRA), comprising the steps of:

defining a first row of elements extending in a first direction, each element of the first row of elements being spaced apart from an adjacent element in the first row of elements by a distance V; and

defining a second row of elements parallel to the first row of elements, each element of the second row of elements being spaced apart from an adjacent element of the second row of elements by the distance V, and the second row of elements spatially displaced from the first row of elements in a direction perpendicular to the first direction by a distance H;

wherein the second row of elements is offset from the first row of elements in the first direction by a stagger distance $S$ such that S/V is between zero and one.

20. (ORIGINAL) The method of claim 19, further comprising the steps of:

selecting a direction of a DRA main lobe; and

computing $H$, $V$, and $S$ from a relationship between the angular position of a plurality of grating lobes and the parameters $H$, $V$, $S$, and a wavelength $\lambda$ of a signal emitted by the DRA.

21. (ORIGINAL) The method of claim 20, wherein the step of computing $H$, $V$, and $S$ from a relationship between the angular position of a plurality of grating lobes and the parameters $H$, $V$, $S$, and a wavelength $\lambda$ of a signal emitted by the DRA comprises the steps of:

defining a triangle formed by a centroid of a first element in the first row of elements, a centroid of a second element in the first row of elements adjacent the first element, and a centroid of a third element in the second row of elements, the third element adjacent the first element in the first row of elements and the second element in the first row of elements;

scaling the triangle by a scale factor $C = \frac{\lambda}{(V \bullet H)}$; and

determining the angular position of the grating lobes from the vertices of the scaled triangle.

22. (ORIGINAL) The method of claim 21, further comprising the step of rotating the scaled triangle by 90 degrees relative to the triangle.

## EVIDENCE APPENDIX

(none)

## RELATED APPEALS AND INTERFERENCES APPENDIX

(none)